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ABSTRACT

This study was designed to develop and validate an instrument to measure general attitudes toward research design and statistics for use with students in an undergraduate nursing research course. Personal feelings of anxiety or lack of competence in dealing with course material were also assessed. Evidence of construct validity was provided by the identification of four interpretable factors which were extracted from responses to the attitude inventory. The factors were: fear of failure, challenge and relevance, lack of interest, and intrinsic value. The attitude inventory was administered on the first and last day of class. The pretest and posttest results were used to measure changes in attitude as a result of instruction. The instrument would be useful in identifying negative attitudes toward statistics and research methodology. (DWH)

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Development and Validation of a Pre-Post Instruction Course Evaluation Questionnaire: A Pilot Study

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The need for the nursing profession to acquire and extend research skills is increasingly acknowledged by schools of nursing, the majority of which now include courses in research methods in their masters' and even in their baccalaureate programs (ANA, 1981). It is possible that the attitudes toward research methodology which are formed during undergraduate study are crucial in determining whether practicing nurses will continue to value and contribute to the research base so necessary for the development of nursing as a distinct discipline. Many nursing students, viewing their chosen profession as an essentially humanistic one, fear that they will sacrifice what Watson (1976) has called "the intuitive voice of experience" in attempting to quantify and measure nursing phenomena objectively. Topf (1976) observed that graduate nursing students at the masters' level lacked statistical and methodological concepts, and attributed this deficit to feelings of anxiety about quantitative methods. In some cases student anxiety was so great that nursing research was established as a negative experience to be avoided later on.

In view of the fact that nursing remains a profession which attracts primarily women, there is a danger that negative perceptions of mathematics and statistics will be major factors in the avoidance of research methodologies based on those disciplines. Fennema and Sherman (1977) in a study of high school students found that women generally experienced greater anxiety about mathematics than men, and were more likely to underestimate their quantitative ability. In another study, the same authors found that, although women verbally denied believing in the mathematical superiority of men, they regarded mathematics as less useful, and showed less interest in taking advanced mathematics courses, than men (Sherman and Fennema, 1977). Wolfe (1978) in a study of graduate students in home economics, nursing and education, found a similar denial of any sex differential in statistical aptitude.

However, students expressed concern about a possible age-related decline in quantitative ability, which was not dispelled by successful experience with a semester course in statistics.

Given the importance of attitudes and other affective correlates of learning, it is essential that their assessment be made a regular part of the evaluation of instruction. The typical course evaluation questionnaire designed for use in college and university classrooms is administered at the end of the term, and contains questions which are highly specific, pertaining to textbooks, readings, quality of instruction, assignments and examinations. While these instruments provide the instructor with much useful information, by nature of their specificity they can only be administered after the course has been taught. Thus, there is no baseline from which to assess attitude change following a course of instruction.

The purpose of the present study was to begin to develop and validate a short tool to measure more general attitudes toward research design and statistics, as well as personal feelings of anxiety or lack of competence in dealing with course material. The tool was designed to be administered on the first and last days of instruction in an undergraduate nursing research course.

METHODS

Sample.

Fifty-four female students in two sections of an undergraduate course in nursing research design participated in the study. All were upper-level generic students in a baccalaureate program in nursing at a large Eastern university. Participation was voluntary, and anonymity of response was assured by the use of random number codes as the only means of matching pre-and post- instruction responses.

Materials.

An attitude inventory consisting of 38 statements, sampling students' feelings about their own ability, motivation and interest, and the relevance and importance of research skills to the nursing profession, was administered following a review of the course syllabus on the first day of class (the pretest) and again on the last day of the class (the posttest). Respondents were instructed to rate their feelings about each statement on a scale of 1 (strongly agree) to 5 (strongly disagree). Following a preliminary item analysis of the pretest data, the 16 statements with the most favorable psychometric properties were identified and used in all subsequent analyses.

Procedure.

Of the 16 items retained, half were positively worded and half were negatively worded. Principal factor analysis of the responses to the 16 pretest items, followed by Varimax rotation, yielded four factors, accounting for 67 percent of the response variance.

RESULTS

In order to facilitate interpretation of factors, the following procedure was used (Gorsuch, 1974). First, all those factor loadings greater than or equal to 0.30 in magnitude were identified as salient or significant. Next, each statement with a salient loading on more than one factor was assigned to that factor on which its loading was the largest in magnitude. Statements with salient loading on only one factor were assigned to that factor. Thus, each statement retained was associated only with that factor with which it correlated most highly. This procedure yielded four experimentally independent, interpretable factors (see table 1).

Insert Table 1 about here

Factor 1 (Fear of Failure) contains statements expressing anxiety, stress and feelings of incompetence in the face of statistics. Factor 2 (Challenge and Relevance) is expressive of the importance and applicability of statistics and research skills to the nursing profession. Statements on Factor 3 (Lack of Interest) express feelings of dullness of course content, boredom with the subject matter, and reluctance to study it unless required to do so. Factor 4 (Intrinsic Value), although bearing only two statements, clearly expresses feelings of pleasure in the study of statistics and research, apart from any practical application.

Pretest and posttest factor scores were next computed for each student, using a simple weighting procedure recommended by Gorsuch (1974). Using this method, the ratings given to statements assigned to a particular factor were summed to give a total score on that factor. Ratings for the single statement with a negative factor loading were reflected prior to summation. Since change in a favorable direction following instruction was anticipated, one-tailed correlated t-tests were performed to examine pre- to post-instruction differences on each factor. Results are shown in Table 2.

Insert Table 2 about here

Differences in the predicted directions were found on all four factors: except for Factor 4, the differences were significant ($p<.05$). Students

reported less stress and fear of failure, greater appreciation of the importance of research skills to nursing, more interest and more enjoyment at the end of the semester than at the beginning.

DISCUSSION

The fact that four interpretable factors were extracted from responses to the attitude inventory, corresponding to meaningful attitudinal dimensions, provides some evidence of its construct validity. It is perhaps worth noting that three of the four factors (Fear of Failure, Challenge and Relevance, and Intrinsic Interest) correspond closely to important dimensions of attitude toward mathematics which have been identified in high school students. Pedro, Wolleat, Fennema and Becker (1981) have found anxiety, perceived usefulness, and effectance motivation (an intrinsic joy in doing mathematics) to be significant predictors of mathematics achievement and the election of further mathematics courses.

Further evidence of construct validity is provided by the "change of performance" approach (Helmstadter, 1964) utilized in the analysis of pre- to post-instruction change. That is, it is reasonable to expect that the students, all of whom received at least a C in the course, would show some change, on each factor, in the direction of a more positive attitude. The greatest shift, proportionally, was on Factor 1 (Fear of Failure), on which the mean pre-instruction score was slightly negative. The smallest shift was on Factor 2 (Challenge and Relevance); however, the pre-instruction mean score was positive to begin with.

The single-group pretest-posttest design used in the present study is, of course, fraught with threats to internal validity. It is not possible to draw causal inferences regarding the effect of the quality of instruction, or the course itself, on student ratings. However, the use of pre-instruction as

well as post-instruction course evaluation may provide the instructor with "testable hypotheses" and help guide curriculum decisions more effectively than a single end-of-term evaluation. In particular, a shift in the direction of negative attitudes from the beginning to the end of the term should alert the instructor to a potential problem requiring close attention.

Further study, with larger samples, must be undertaken. However, the results of the present study indicate that a short questionnaire, taking only a few minutes to complete at the beginning and end of a term of instruction, may yield useful data on the affective outcomes of learning in an undergraduate course in nursing research.

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Table 1. Factors Identified in Pretest Data

Factor Loading	Statement
	Factor 1 (Fear of Failure)
0.81	Statistics can only be mastered with a great deal of effort.
0.80	I have almost no natural aptitude for statistics.
-0.69	I am confident of my ability to analyze research data.
0.69	The word "statistics" scares me.
0.57	Fear of failure would keep me from undertaking a research project on my own.
0.53	Taking a course in research methods is a stressful experience.
	Factor 2 (Challenge and Relevance)
0.72	Learning to work as part of a research team is important in nursing.
0.69	Nursing research is a challenge and stimulating field.
0.51	Statistics opens up a whole new way of thinking about nursing.
0.40	Research skills are important in the practice of a biosocial science such as nursing.
0.32	There are many applications of statistics to the various clinical areas in nursing.
	Factor 3 (Lack of Interest)
0.73	Statistics and research methods are dull, boring topics.
0.63	I would not take a course in research and statistics if it were not required.
0.45	It is almost impossible to overcome past negative experiences with math and statistics.
	Factor 4 (Intrinsic Value)
0.71	I enjoy math, including statistics.
0.69	Math is interesting to me.

Table 2. Means and Standard Deviations of Pre- and Post-Instruction Factor Scores

		X	S.D.
Factor 1	Pre-Instruction	17.37	5.42
	Post-Instruction	20.20*	4.68
Factor 2	Pre-Instruction	12.72*	2.56
	Post-Instruction	11.85	3.02
Factor 3	Pre-Instruction	8.39*	2.33
	Post-Instruction	9.56	2.13
Factor 4	Pre-Instruction	6.33	2.30
	Post-Instruction	5.83	2.15

*$p < .05$

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NURS 410 - OPINION SURVEY

Directions: We are interested in finding out how you feel about studying research methods and statistics. What is wanted in your honest reaction to each statement - there are no "right or wrong" answers. Please indicate the extent to which you agree or disagree with each statement, according to the following scale:

(1)	(2)	(3)	(4)	(5)
Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree

1. Statistics courses take up too much of a student's time.
2. Statistics and research methods are dull, boring topics.
3. Research skills are important in the practice of a biosocial science such as nursing.
4. Statistics can only be mastered with a great deal of effort.
5. I have almost no natural aptitude for statistics.
6. Data analysis is dull and tedious.
7. I will be more valuable to the nursing profession after studying statistics.
8. Anyone who has had difficulty with math or statistics in the past will have difficulty with this course.
9. I am comfortable with statistics.
10. I like the idea of working with minicomputers.
11. Nursing research can only be evaluated properly by someone with a knowledge of research methods and statistics.
12. I worry that I will never know enough about statistics.
13. I enjoy math, including statistics.
14. The word "statistics" scares me.
15. Taking a course in research methods is a stressful experience.
16. Life is simpler and more interesting for someone with a knowledge of mathematics.
17. I'm confident of my ability to participate in a nursing research project.
18. I suffer from "math anxiety."

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19. Leadership in nursing is based on a thorough grasp of research skills.

20. Statistics opens up a whole new way of thinking about nursing.

21. Math is interesting to me.

22. I have positive feelings about nursing research.

23. There are many applications of statistics to the various clinical areas in nursing.

24. Studying statistics causes the student to lose sight of the uniqueness of each individual human being.

25. Research skills are essential to the development of a scientific base for nursing.

26. I am confident of my ability to analyze research data.

27. Learning to work as part of a research team is important in nursing.

28. Fear of failure would keep me from undertaking a research project on my own.

29. I am overwhelmed by the prospect of participating in a class research project.

30. Nursing research is a challenging and stimulating field.

31. The material in this course seems quite irrelevant compared to my actual nursing experience.

32. It is almost impossible to overcome past negative experiences with math and statistics.

33. I am excited by the prospect of being able to do valid nursing research.

34. This course will enable me to apply statistical techniques in my own research and professional practice.

35. The material learned in this course will be useful in other courses.

36. Above-average ability in math is needed to succeed in this course.

37. I would not take a course in research and statistics if it were not required.

38. The topics of statistics and research methods seem unrelated to real life.

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